StarFinder AVL
Owners Manual & Reference Guide

Revision 2.0 –January 04

GSM/SMS Version
850/1900 MHz. – 900/1800 MHz.

Important!

Before to install, turn on, or operate the Starfinder AVL Unit ensure the total accomplishment of your local safety regulations

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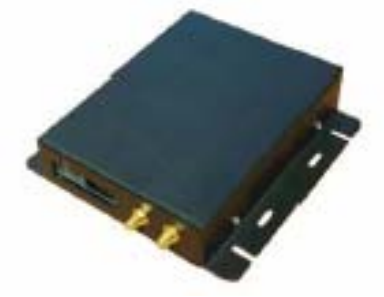
1. Introduction

Overview



Laipac's Starfinder AVL system provides a very low cost but powerful solution for automatic vehicle location and other GPS tracking applications. It combines with GPS technology with cell phone networks, and was designed for multiple automotive applications such as vehicle tracking, monitoring, remote control, and GPS data logging. In normal condition, it's DB9 serial port has NMEA $GPRMC sentence output which can be used for in-car navigation. In data log download condition, the DB9 output is switched to logged data output and can be connected with a PDA, Laptop, short range wireless modules or Bluetooth devices for local positions download.

Since the SMS is a connectionless communication, each message should have its own acknowledgement message. Starfinder AVL's communication protocol has been specifically designed to closely reassembled the NMEA sentence in format, but all commands consist of sets of command pairs which have both request and response commands. The response command returns the execution result of each command to confirm that each command has been executed correctly.

Features

- Just 15 x 15 x 3.5 cm.
- Power, NMEA & GSM LED indication
- 2 x Input by Input-coupler to protect internal circuit from high voltage
- 2 x relay output of 15A, ideal for enable and disable of car's ignition or trigger other electronic devices.
- 1 x RS232 output for data logger downloading or NMEA output device for in-car navigation purpose.
- Keyfob Panic Transmitter as optional accessory
- MIC and Speaker external connection available as optional
- Geofence capability
- Data logger ready device with 512Kb internal flash memory. It records time stamp, speed, position and I/O state .
- Time interval and distance travel setting for position report and data recording
- Intelligent logging by setting min. distance Password and Unit ID setting by air
- Additional RJ11 port for external analog sensors
- Additional RJ11 port for external TTL digital peripheral devices
- High performance Laipac GPS receiver built in, the accuracy is 3mts in North America (WAAS) & Europe (EGNOS) and 10mts in the world
- Get event warning when vehicle gets outside of selected Geofences

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Hardware & Software requirements (for GSM 900/1800 or 850/1900)

Starfinder AVL system for GSM has built-in GSM dual band modem.

GSM worldwide coverage is divided into 900/1800 and 850/1900 band. For USA, Canada, Mexico, countries in Central and South America (except Brazil), the suitable unit is Starfinder AVL 850/1900. For European countries, Asia , Brazil, Africa countries and Middle East, the suitable unit is Starfinder AVL 900/1800.

The Starfinder AVL unit is delivered without a SIM card. SIM cards must be purchased and registered with your local GSM carrier. Starfinder AVL GSM works through SMS (Short Message Service) which is also commonly known as Text Messaging Service. Once you have the SIM Card, place it into the SIM card holder of Starfinder AVL unit.

Starfinder AVL system is delivered together with CD and diagnostic software called Starfinder AVLDiag. The users can use Starfinder AVLDiag to configure and test the Starfinder AVL system. It may also be used to perform simple vehicle tracking.

For fleet management and other commercial applications, we strongly suggest to use more powerful software such as Starfinder AVL Software or comparable packages.

Throughout this manual it will be assumed that the user has access to a 32-bit Microsoft Windows® machine to run the Starfinder AVLDiag software. For testing over a wireless network, a GSM external modem will be required. We suggest the Fast Track® modem from Wavecom Inc. Laipac Technology also provide the complete evaluation kit which includes this external modem inside the package.

The only other requirement is the Starfinder AVL system itself, complete with an active GPS antenna and GSM antenna (all included inside the package) and the source of 12V-24V DC power such as car / truck's power supply or battery.

Starfinder AVL series of product will be released during 2003 and 2004. These include GPRS, CDMA/1X , LTR VHF & UHF Radio and Satellite modem. Starfinder Personal Locator S-911 (new product under development) has the same concept for high quality, easy to use and low cost design for Location Base Service applications.

Before installing the Starfinder AVL Unit

Please make sure, that you have a SIM-card for the Starfinder AVL Unit that satisfies the following requirements:

- **Caller ID from your GSM service provider allowed.**
- **Short Message Service (SMS) has to be supported by your service provider and activated.**
- **Remove all kind of PIN protection of your SIM cards.**

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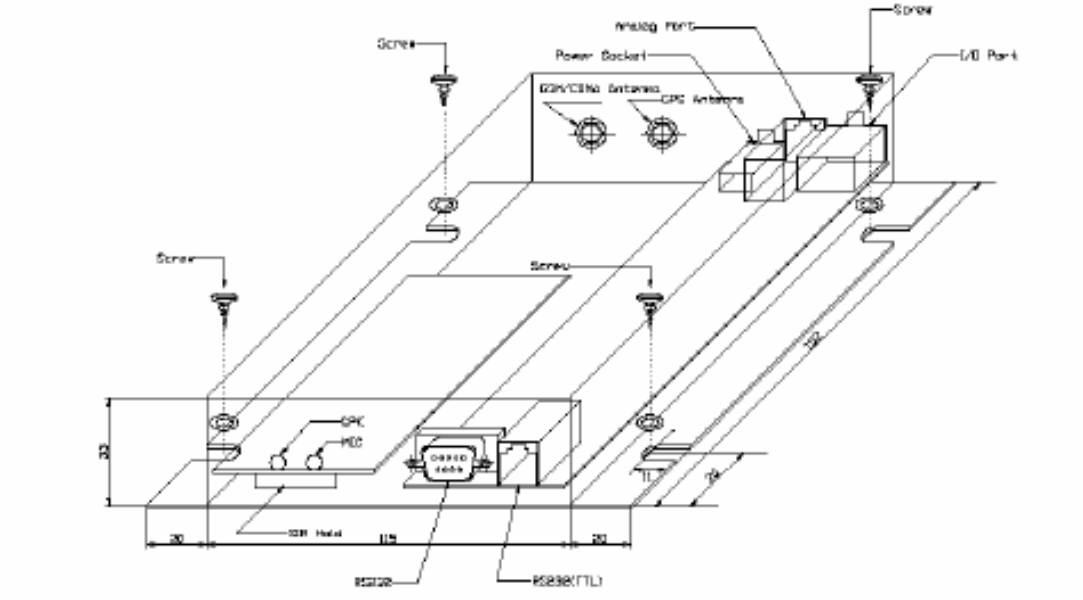
2. Hardware Installation



The standard installation of Starfinder AVL System only requires connection to a constant power supply, a switched power indicator (Ignition), and the placement of the combined GPS antenna/receiver. Total installation time is often less than an hour.

Optionally, hidden "panic" buttons can be placed at convenient locations in the vehicle and additional connections to sensors and vehicle controls can be made by crimping connectors directly to the appropriate wires. However, these connections are *not required*. Only a constant power supply and a switched power indicator (Ignition sense) are required.

The Starfinder AVL Unit contains the AVL system's primary electronic components. Always mount the main module in the vehicle's interior compartments, in a covert and secure location, ensuring that moisture, vibration and temperature extremes are minimized. Acceptable locations include behind the dash, behind the glove compartment, in the trunk, under the seat or other interior panels.

Mounting Antennas

Antenna's Installation Guidelines

- ***Mount antennas securely*.**
- ***RF connectors must be properly connected to the RF cable*. Be sure to *use proper crimping tools.***
- ***Use a good quality low loss cable as provided***
- ***Mount GPS antennas where they will see the most sky***
- ***Mount antennas in areas with enough space for a ground plane.***
- ***Don't mount antennas very close to another antenna, at least 2 inches (6 cm.) of separation are required***
- ***Don't mount antennas close to people, always leave at least 7 inches (+/- 20cm).***
- ***Don't mount antennas where they are covered or blocked by metal.***
- ***Don't put antennas where they are close to electronic management and control systems***

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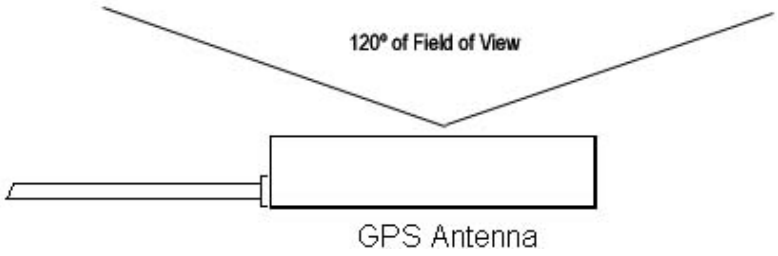
GPS Antenna

At sight Installation

Mount the GPS antenna on an area of the vehicle where there is no obstruction to the sky e.g.: through the window of the car. The GPS antenna may be mounted covert so long as the material obstructing the view of the antenna is plastic, glass or cloth in material. Do not mount the antenna where it is obstructed by metal or electrical interference.

The recommended location for the GPS antenna is the roof of the vehicle. A magnetic mounting method permits mounting in suitable areas. If the area is not metal surface, epoxy can be used, or an alternate through-hole mount antenna can be installed.



Covert Antenna Installation

If it is essential that the antenna be fitting out of site, consider the following:

- **The view of the sky must be as wide as possible**
- **The field of view must not be obscured by any metallic object (including windshield wipers, front windscreens with heating, UV filters or metallic tints)**
- **The top of antenna should point towards the field of view**
- **Signal strength is enhanced if antenna is mounted directly onto metal**

Considering these points, the GPS antenna should be mounted under a window, normally either the front or rear screen, as these generally provide the maximum view of the sky.

Although, generally it is acceptable for the antenna to be located under the dash lining, under a non-metallic parcel shelf (i.e. bumps) or within an instrument or light cluster.

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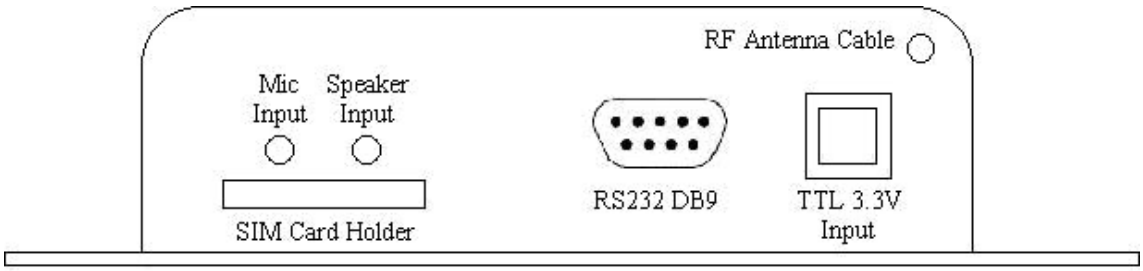
Front Connectors



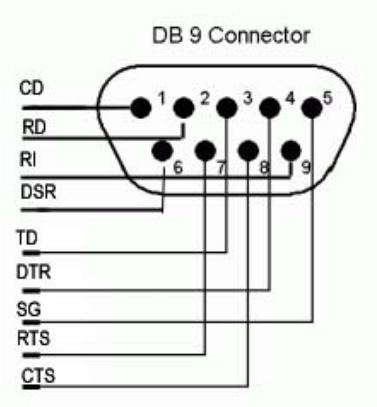
1) Microphone Input: Reserved for customized designs under customer request.

2) Speaker Input: Reserved for customized designs under customer request.

3) SIM Card Holder : The external SIM holder is used for holding SIM card which is required by the GSM modem inside the Starfinder AVL.

4) RS232 Connector : This is the DB-9 connector used to attach a communications device, PDA, Laptop or PC. The connector is configured as a DTE (data terminal equipment) the same like a PC serial port, so direct connection to a PC will require the standard RS232 cable.

Pin	*Definition*
1	**CD – Carrier detect**
2	**RD – Receive data**
3	**TD – Transmit data**
4	**DTR - Data terminal ready**
5	**SG – Signal ground**
6	**DSR – Data set ready**
7	**RTS – Request to send**
8	**CTS – Clear to send**
9	**RI – Ring indicator**



5) Digital Port (RJ11 Connector): Reserved for future.
Ideal for RF modules, Bluetooth devices , Barcode reader and Display Terminal.

6) RF Antenna Cable

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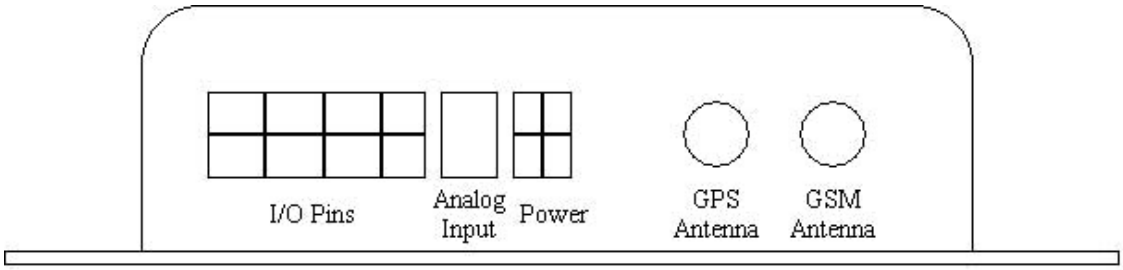
Back Connectors



On the back view of the Starfinder AVL there are three connectors from left to right:

1) I/O port

The I/O port layout is as following (from left to right):

2	**4**	**6**	**8**
1	**3**	**5**	**7**

Name	*Relay1*	*Relay2*	*INPUT 1*	*INPUT 2*
Default Status	**Open**	**Close**	**Trigger by Input**	**Trigger by Input**
Pin Number	**Pin2**	**Pin4**	**Pin6**	**Pin8**
Pin Number	**Pin1**	**Pin3**	**Pin5**	**Pin7**

Connection tips:

- **Relay1 is Normal Open (disconnected between Pin1 and Pin2) - The action to turn on Relay1 means to connect Pin1 and Pin2**
- **Relay2 is Normal Close (connected between Pin3 and Pin4) - The action to turn on Relay2 means to disconnect between Pin3 and Pin4**
- **Pin5 is Positive and Pin6 is negative for input INPUT 1 (volt. range 5–24V) - A event triggered by input 1 is applying the voltage to Pin5 and Pin6**
- **Pin7 is Positive and Pin8 is negative for input INPUT 2 (volt. range 5–24V) - A event triggered by input 2 is applying the voltage to Pin7 and Pin8**

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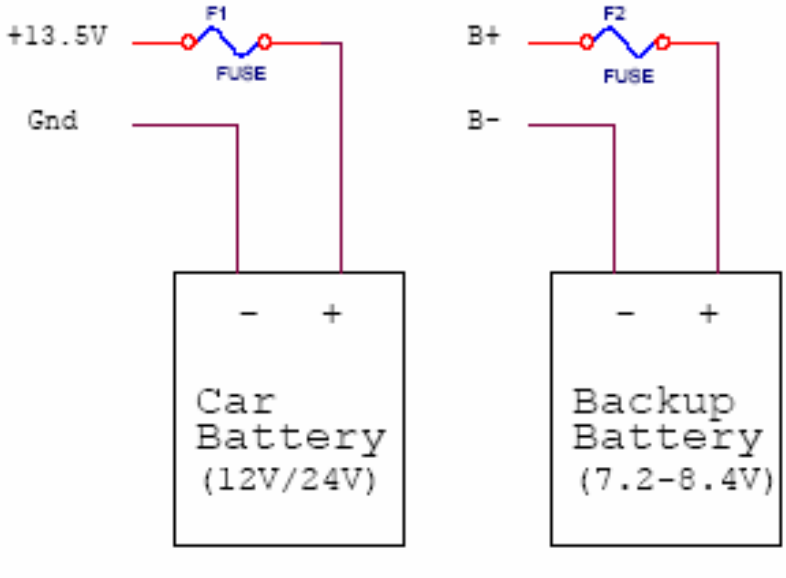
PIN #	I/O NAME	Polarity	General Description	Suggested Connections
1	Relay 1-1	Positive	Output Relay 1 Close the circuit when is triggered	Ignition
2	Relay 1-2	Negative	Input Relay 1 Close the circuit when is triggered	Ignition
3	Relay2-1	Positive	Output Relay 2 Open the circuit when is triggered	Door Lock
4	Relay 2-2	Negative	Input Relay 2 Open the circuit when is triggered	Door Lock
5	Input 1-1	Positive	Output Input-1 – 3 to 12v – Trigger Applying voltage	Mechanical Panic Button
6	Input 1-2	Negative	Input Input-1 3V to 12V - Trigger Applying voltage	Mechanical Panic Button
7	Input 2-1	Positive	Output Input-2 – 3V to 12V – Trigger Applying voltage	Customized external Circuit
8	Input 2-2	Negative	Input Input-2 – 3V to 12v – Trigger Applying voltage	Customized external Circuit

2) Analog Port (RJ11 Connector)

Ideal for temperature sensor, pressure sensor and other analog devices

3) Power Terminal

GND (-)	Battery Backup (-)
Main Power (+) +13.5V (+9 to +30V)	Battery Backup (+)



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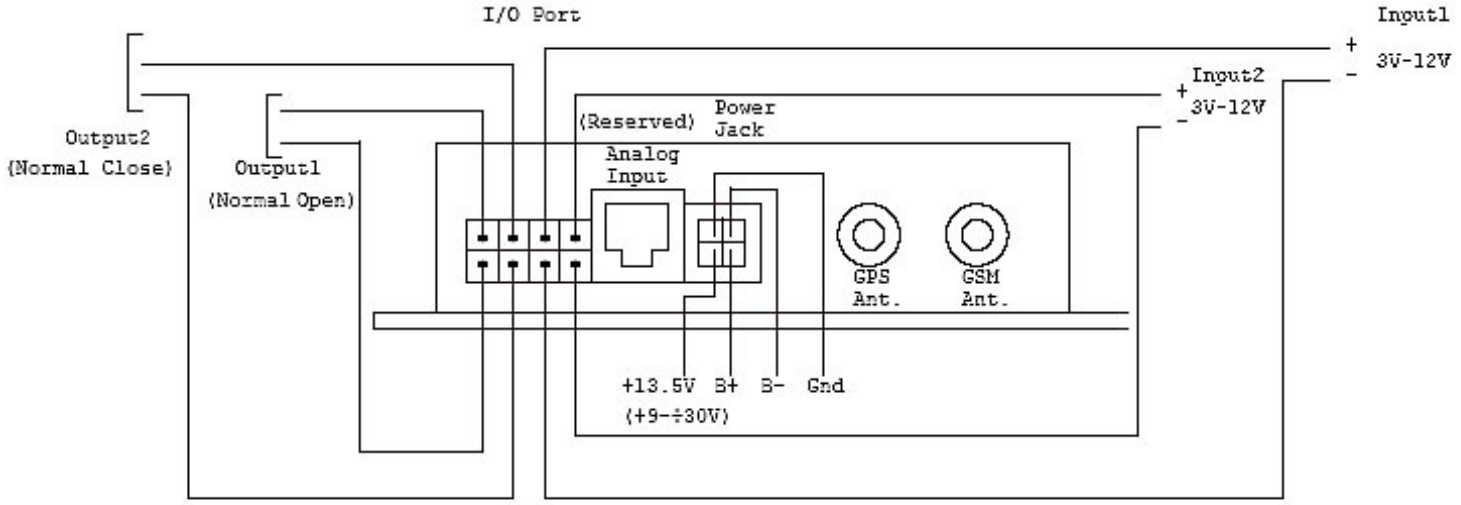
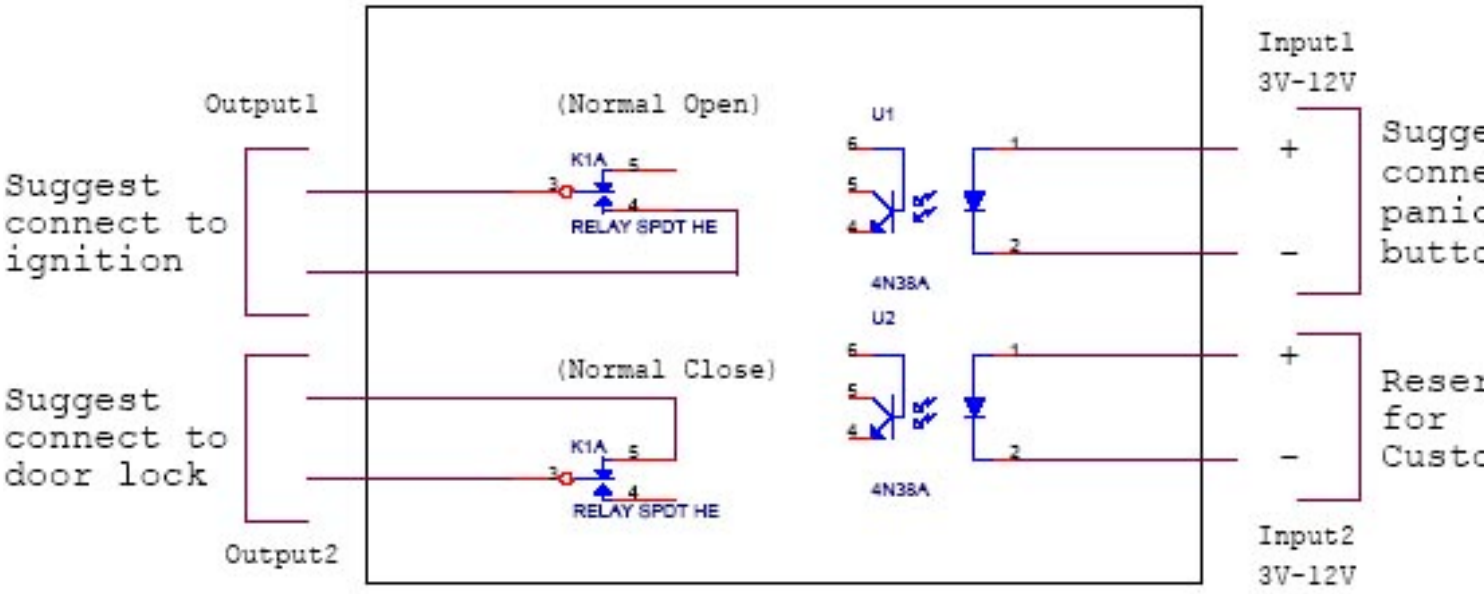
4) GPS Antenna: Typical Active GPS Antenna with SMA connector

5) GSM Antenna: Typical Passive GSM Antenna with SMA connector

Installation Example



Back I/O Layout



Suggested I/O Connections

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3. Hardware Operation

Power consumption

The Starfinder AVL system typically consumes around 140mA at 13.8V with an extra 50mA consumed when each relay is activated. The following table summarizes power consumption measured during normal operation.

State	*Voltage*	*Current*
Both relays off	13.8V	140mA
One relay on	13.8V	190mA
Both relays on	13.8V	240mA

Note: Starfinder AVL has option to switch the high accuracy GPS to an alternative low power 16Ch. GPS receiver with GPS shut down feature. The current consumption can drop down to 500mA in stand-by mode. MOQ will be required.

Reset function

The reset jumper J6 may be shorted pressing the external reset button (left side in front view) during a power-up cycle to reset all parameters and data held in non-volatile memory. This is useful if the password is forgotten or other parameters such as the modem type have been set to unknown values. It may also be required after the system software has been upgraded, please contact Laipac's technical department for the consultation of the case.

Note that when the jumper is shorted it will take a while for the non-volatile memory to be erased. The following table is a guide to the amount of time various memory configurations will take to reset.

Memory Size (KB)	*Approximate Time*
4K	1 minute
8K	2 minutes
16K	3 minutes
32K *	6 minutes
64K	12 minutes

The system will take the same amount of time to start up when the non-volatile memory contains invalid data. Typical examples of this are when the system is powered up for the first time or the memory chip has been replaced with a different type.

For this reason patience is recommended when first starting the system if it fails to respond as it may be caused by the non-volatile memory being reset. It also takes the GPS longer to acquire after a system is first installed (or has been out of operation for over a week) so it is recommended that the system be left for at least 6 minutes with the antenna and power connected before attempting communications for the first time.

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Configuration

There are two different ways to configure the Starfinder AVL Unit:

1. **By Air, using the GSM/SMS network, and**
2. **Locally, connecting the Starfinder AVL unit trough COM port to a IBM-PC compatible and use the operating system Windows 2000 or XP. (Linux & OS/2 are not supported)**

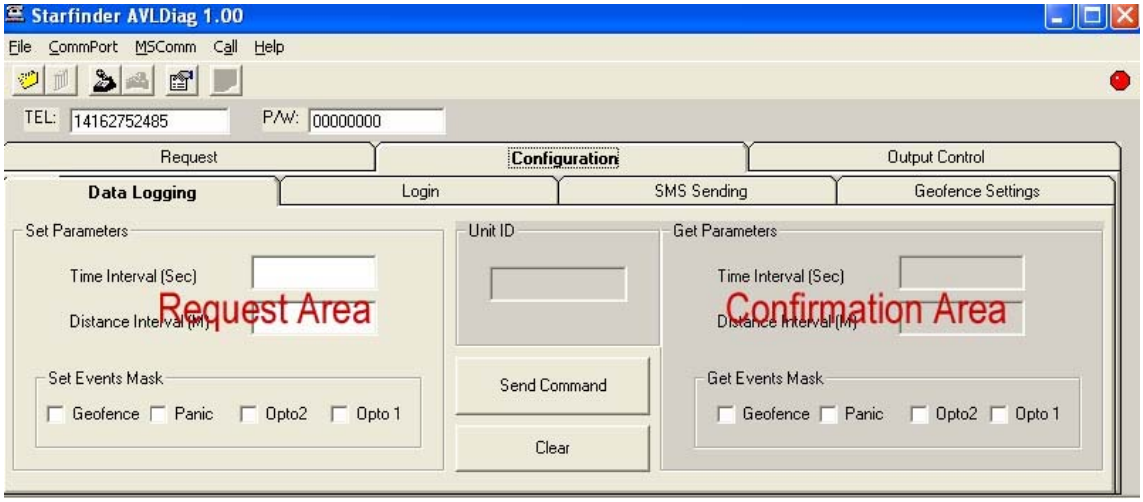
1 – Configuration by Air.

This remote configuration can be do it using the AVLDiag or Starfinder AVL Software. Here are described only the procedures using the AVLDiag, for the Starfinder AVL Software please refers to their User's Manual.

Installing and operating the AVLDiag software

The Starfinder AVLDiag software is provided free of charge as a simple diagnostic and learning tool for Starfinder AVL new users.

For current version, Starfinder AVL has ten commands in total, every command is returned by the Starfinder AVL Unit and showed in the grey window area:



To understand how the AVL Diag commands been classified, it may be a great help a quick start. The Starfinder commands can be classified into the following categories:

- **Request Command**
- **Configuration Command**
- **Control Command**

The following sections of the manual discuss these categories in detail and show examples of using the AVLDiag software.

1. Get System Information Using Starfinder AVLDiag Software:

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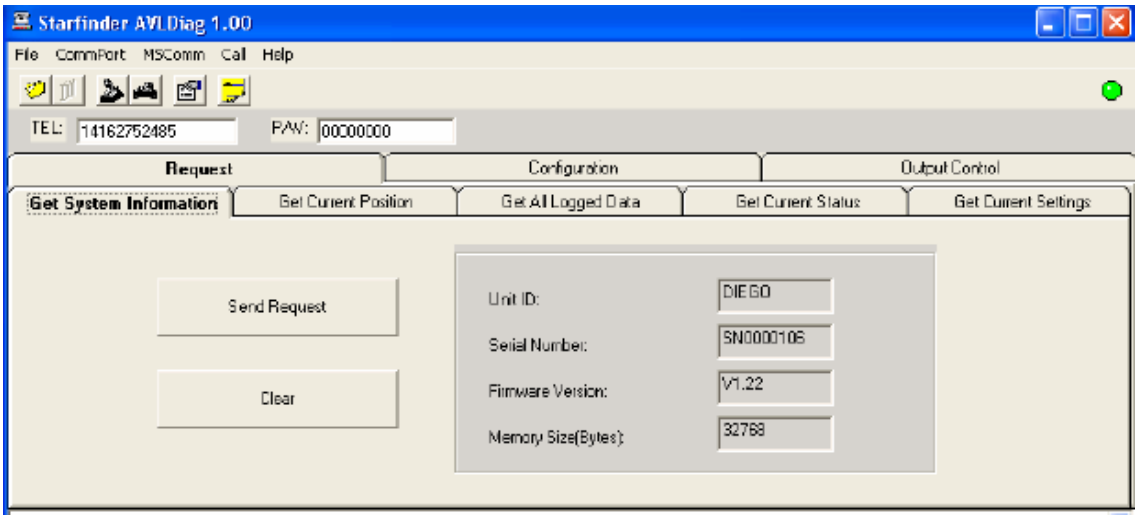
Start->All Programs->Star Finder AVLDiag1.00->Request->Get System Info:

Filling in the correct Starfinder Unit phone number in 'TEL' text box. The Phone number is the SIM card's telephone number assigned by the GSM service provider
Filling in the correct password (the factory default is '00000000', default Unit ID is '99999999')
Press 'Send Request' button, then wait for Starfinder Unit's system information to appear press 'Clear' button can clear previous received message.

Note : The SMS text message doesn't get lost, so be patient to wait for acknowledgement message. Do not attempt to resend request messages within seconds.



2. Get Current Position Using Starfinder AVLDiag Software

This command requests the current position of the Starfinder AVL unit. The GPS is sampled every second so a valid GPS fix within the last second will be returned assuming that the GPS is currently in tracking mode. In case where the system does not have a valid GPS fix, such as the GPS antenna is obscured, the last valid GPS position will be retrieved.

Start->All Programs->Star Finder AVLDiag1.00->Request->Get Current Position:

Filling in the correct Starfinder Unit phone number in 'TEL' text box
Filling in the correct password (the factory default is '00000000', default Unit ID is '99999999')
Press 'Send Request' button, then wait for NMEA information to appear.

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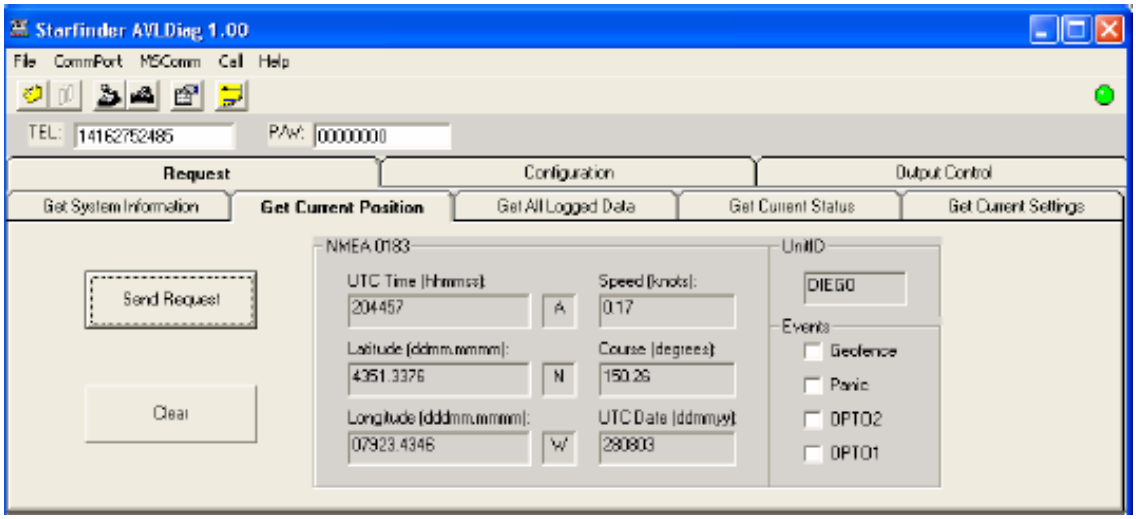
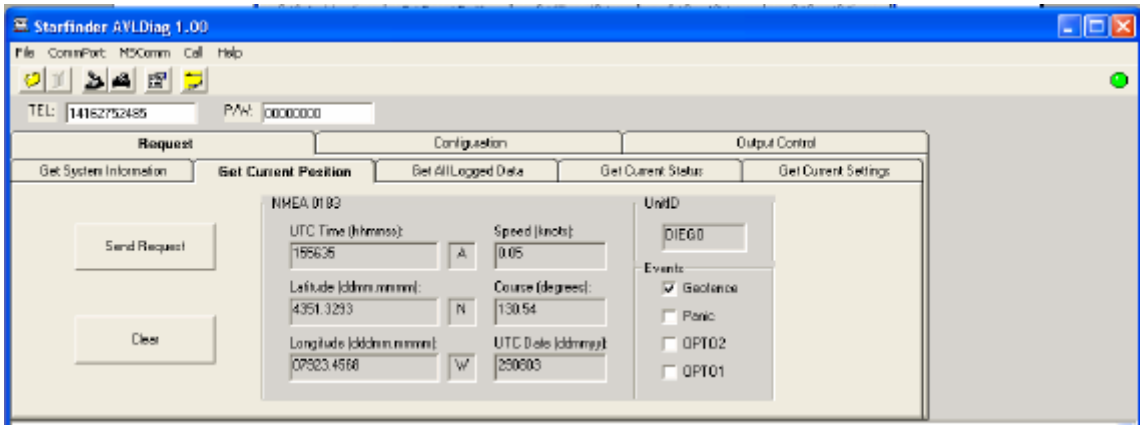


Note: The above message can also be trigged by events. For example, if geofence is set, and Starfinder AVL finds the vehicle is out of geofence.

For geofence event, the received message is:



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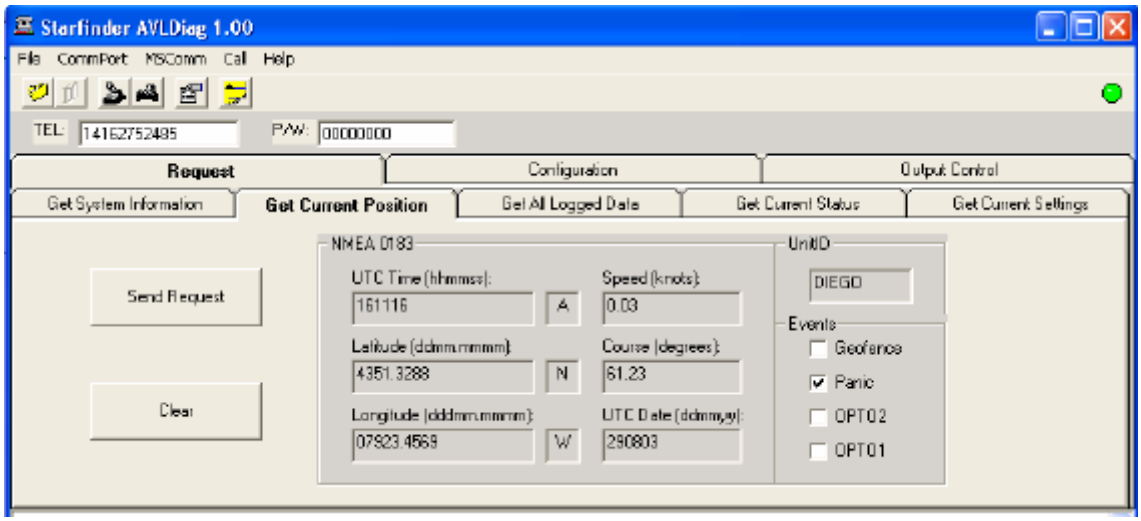
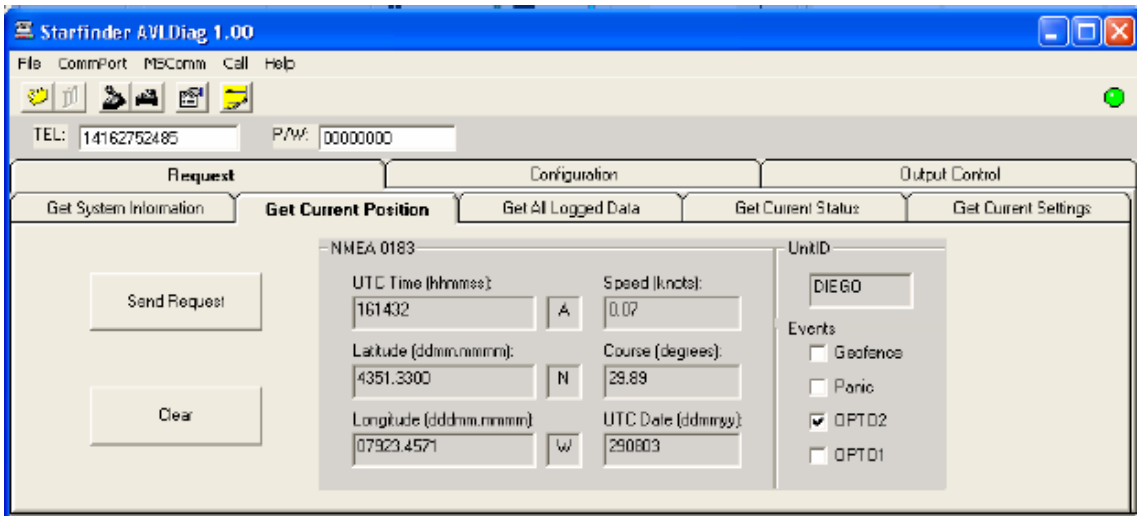
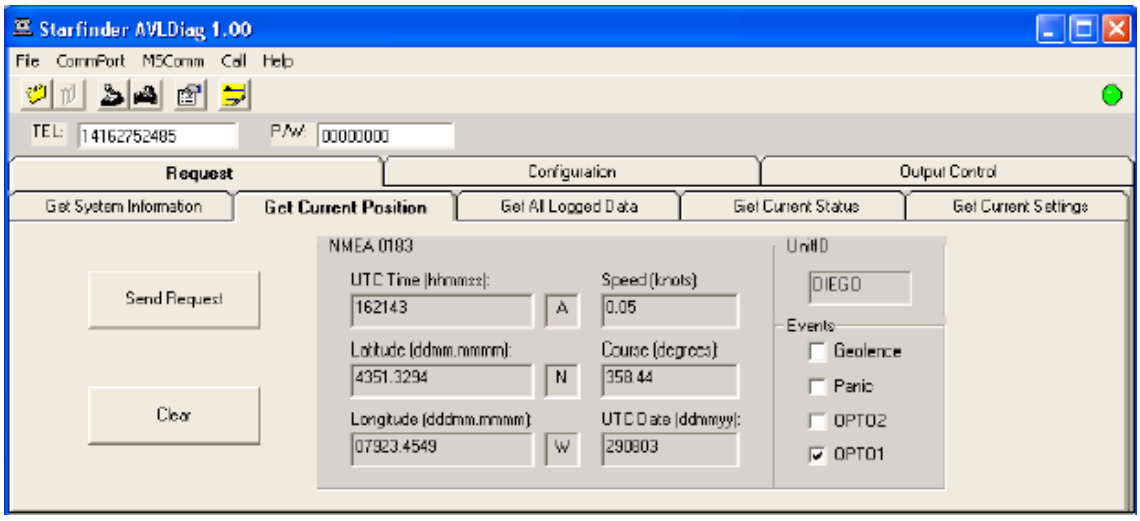
For panic event, the received message is:



For Input 2 (input2) event, the received message is:



For Input 1(input1) event, the received message is:



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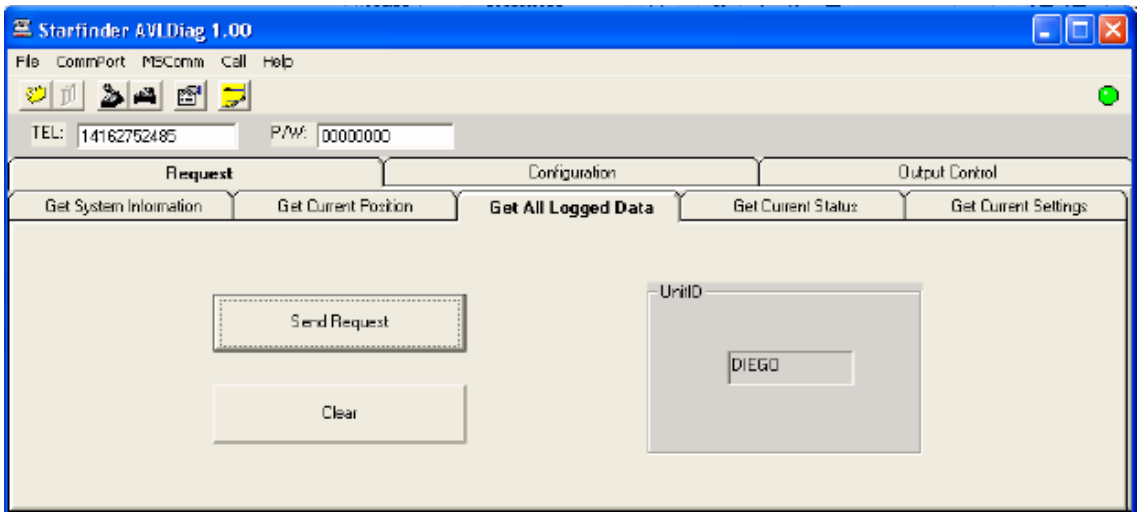
3. Get All Logged Data:

This command requests all GPS data that has been logged by the Starfinder AVL. How often data is logged depends on the logging configuration parameters defined as below. Data is sent as a sequence of $GPRMC sentences with a success response indicating that all data has been sent. Response codes are defined in a later section. Executing this command requires a valid password.

Start->All Programs->Star Finder AVLDiag1.00->Request->Get All Logged Data:

Filling in the correct Starfinder Unit phone number in 'TEL' text box
Filling in the correct password (the factory default is '00000000', default Unit ID is '99999999')
Press 'Send Request' button, then Starfinder AVL begins to download all logged data from Starfinder's DB9 serial port. When the downloading is completed, the Starfinder AVL will send Unit ID back as an acknowledgement.



4. Get Current Status:

Start->All Programs->Star Finder AVLDiag1.00->Request->Get Current Status:

Filling in the correct Starfinder Unit phone number in 'TEL' text box
Filling in the correct password (the factory default is '00000000', default Unit ID is '99999999')
Press 'Send Request' button, then wait for status information to report back

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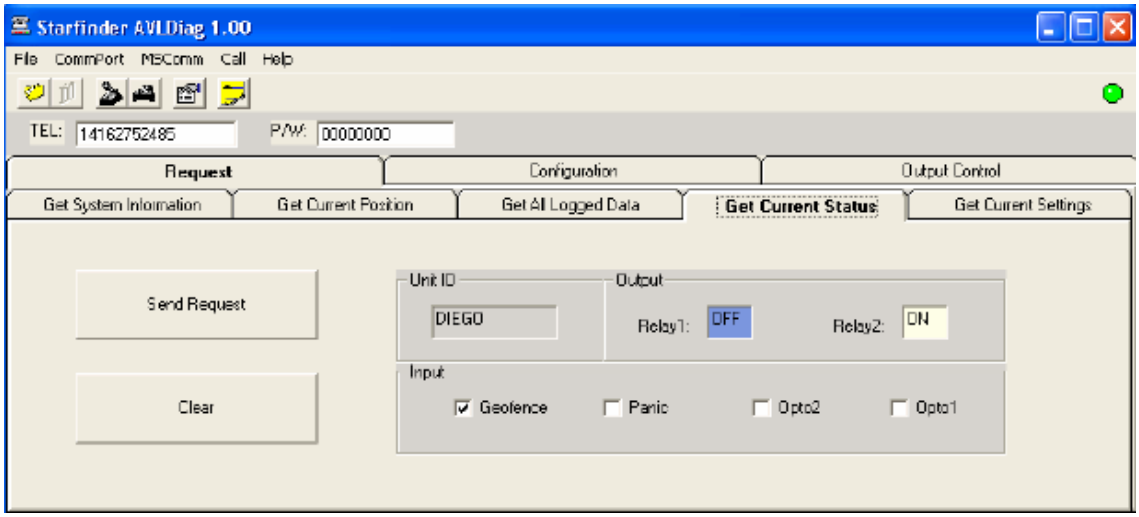
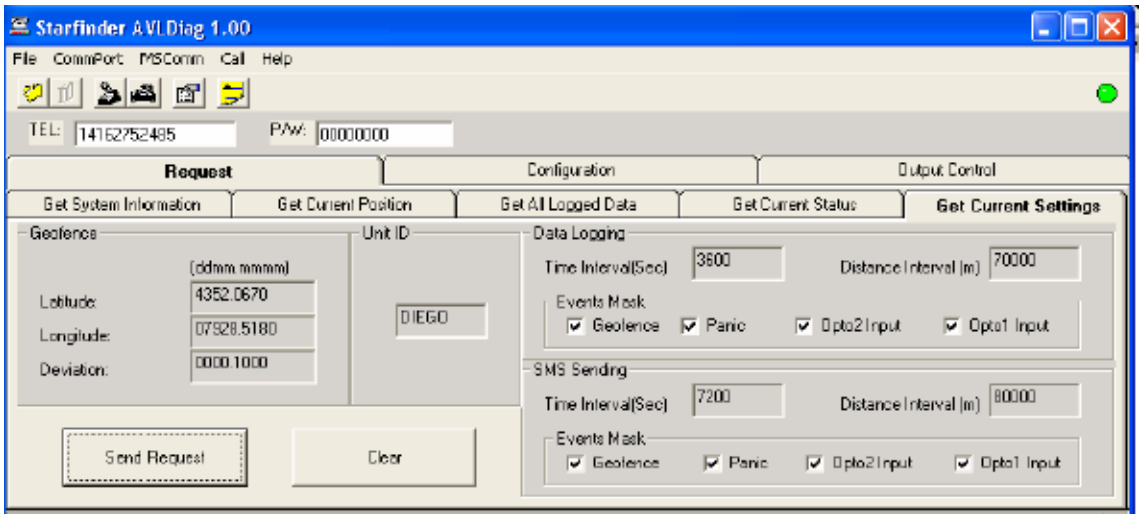


5. Get Current Settings:

Start->All Programs->Star Finder AVLDiag1.00->Request->Get Current Settings:

Filling in the correct Starfinder Unit phone number in 'TEL' text box
Filling in the correct password (the factory default is '00000000', default Unit ID is '99999999')
Press 'Send Request' button, then wait for setting parameters to report back



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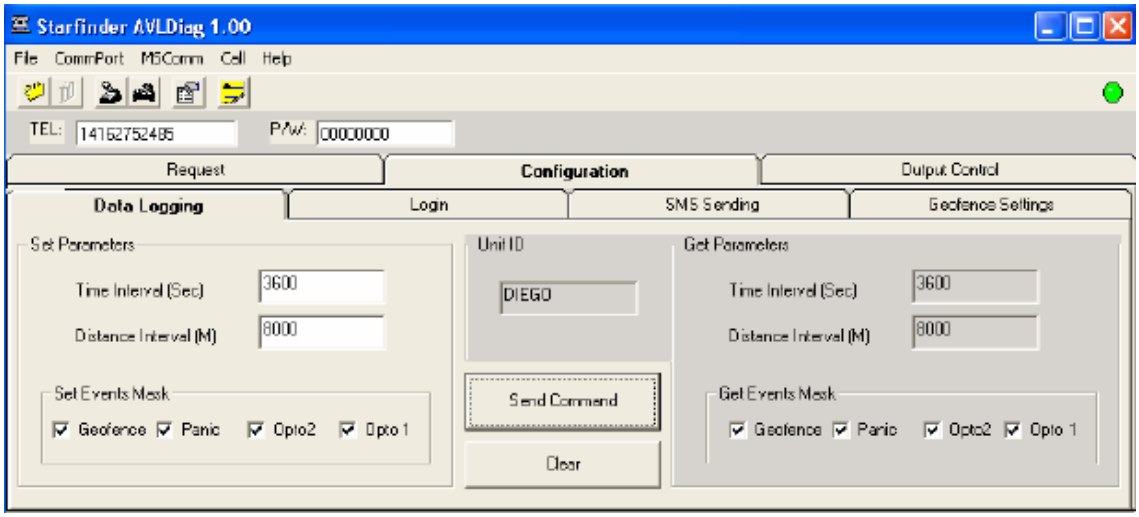
Configuration Command

Configuration command consist of four commands

1. **Data Logging Configuration Command:**

Start->All Programs->Star Finder AVLDiag1.00->Configuration->Data Logging

Filling in the correct Starfinder Unit phone number in 'TEL' text box
Filling in the correct password (the factory default is '00000000', default Unit ID is '99999999')
Filling the data logging time interval
Filling the data logging distance interval
Set the event mask options
Press 'Send Request' button, then wait for parameter setting confirmation message to report back
Press 'Clear' button can clear previous received message.



2. **Logging Account Configuration:**

This command configures the system parameters as described in a previous section. Please note that all numbers are expressed in decimal notation. Any parameter that is left blank will leave that parameter as previously programmed.

Executing this command requires a valid password.

Start->All Programs->Star Finder AVLDiag1.00->Configuration->Login

Filling in the correct Starfinder Unit phone number in 'TEL' text box
Filling in the correct password (the factory default is '00000000', default Unit ID is '99999999')
Filling the new UNIT ID
Filling the new password
Press 'Send Request' button, then wait for parameter setting confirmation message to report back
Press 'Clear' button can clear previous received message.

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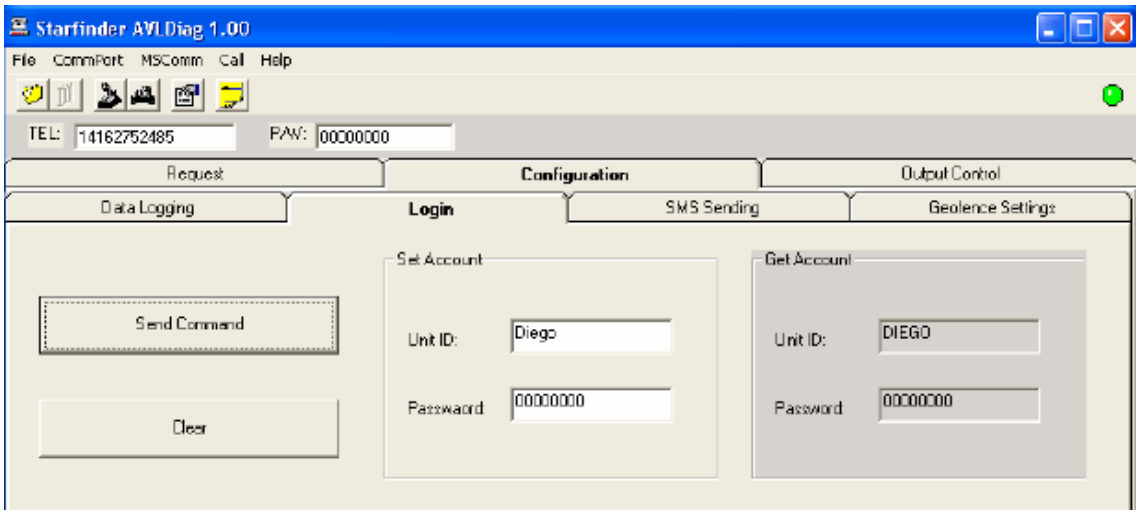


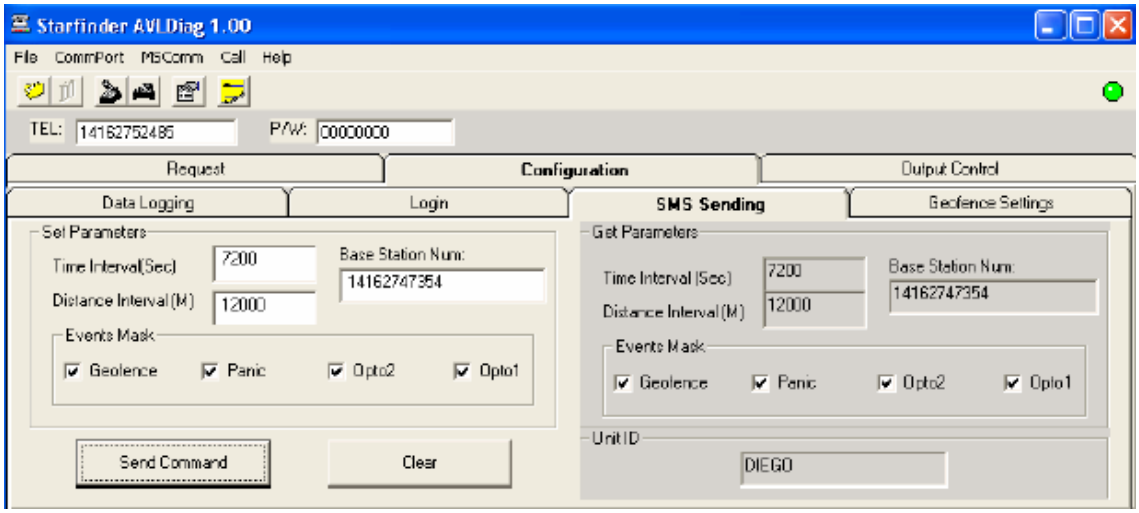
3. SMS Sending Configuration:

This command configures the communication parameters as described in previous section. Please note that all numbers are expressed in decimal notation. Any parameter that is left blank will leave that parameter as previously programmed.

Executing this command requires a valid password.

Start->All Programs->Star Finder AVLDiag1.00->Configuration->SMS Sending

Filling in the correct Starfinder Unit phone number in 'TEL' text box
Filling in the correct password (the factory default is '00000000', default Unit ID is '99999999')
Filling the SMS sending time interval
Filling the SMS sending distance interval
Set the event mask option
Press 'Send Request' button, then wait for parameter setting confirmation message to report back
Press 'Clear' button can clear previous received message.



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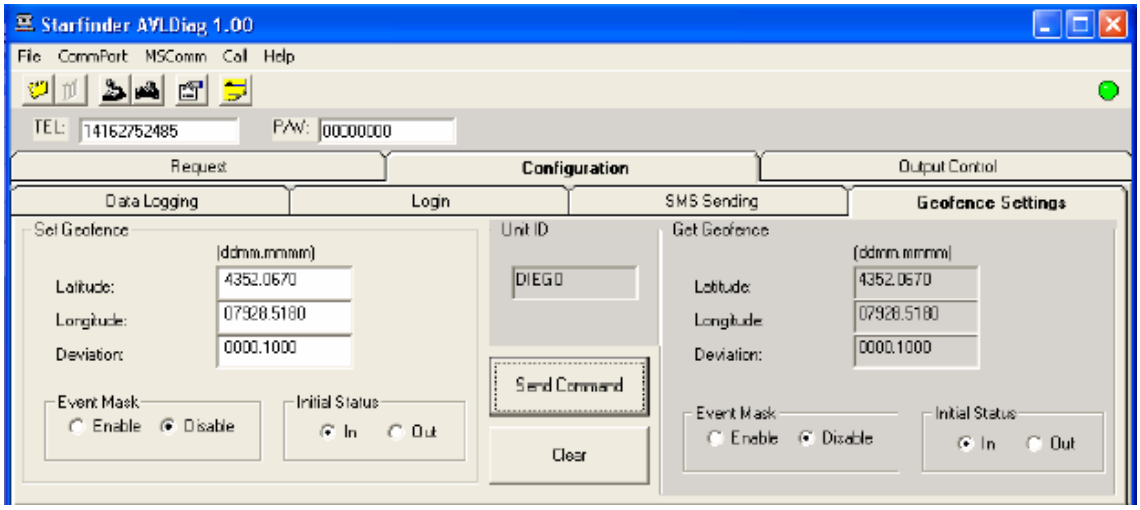
4. Geofence Configuration:

This command is used to set geofence area for the Starfinder AVL system. When vehicle is out of geofence area, Starfinder AVL will report the position to the central host. Executing this command requires a valid password.

Start->All Programs->Star Finder AVLDiag1.00->Configuration->Geofence Settings

Filling in the correct Starfinder Unit phone number in 'TEL' text box
Filling in the correct password (the factory default is '00000000', default Unit ID is '99999999')
Filling the geofence center point's latitude
Filling the geofence center point's longitude
Filling the geofence latitude and longitude deviation (delta)
Choose a geofence event mask option
Giving the initial status of geofence
Press 'Send Command' button, then wait for parameter setting confirmation message to report back
Press 'Clear' button can clear previous received message.



Control Command

There is only one control command. This command is used to control the output port. Executing this command requires valid password to be specified.

1. Control Relay1:

Start->All Programs->Star Finder AVLDiag1.00->Control->Relay1

Filling in the correct Starfinder Unit phone number in 'TEL' text box
Filling in the correct password (the factory default is '00000000', default Unit ID is '99999999')
Press 'ON' button to switch relay1 ON, or press 'OFF' button to switch relay1 OFF, then wait for parameter setting confirmation message to return back

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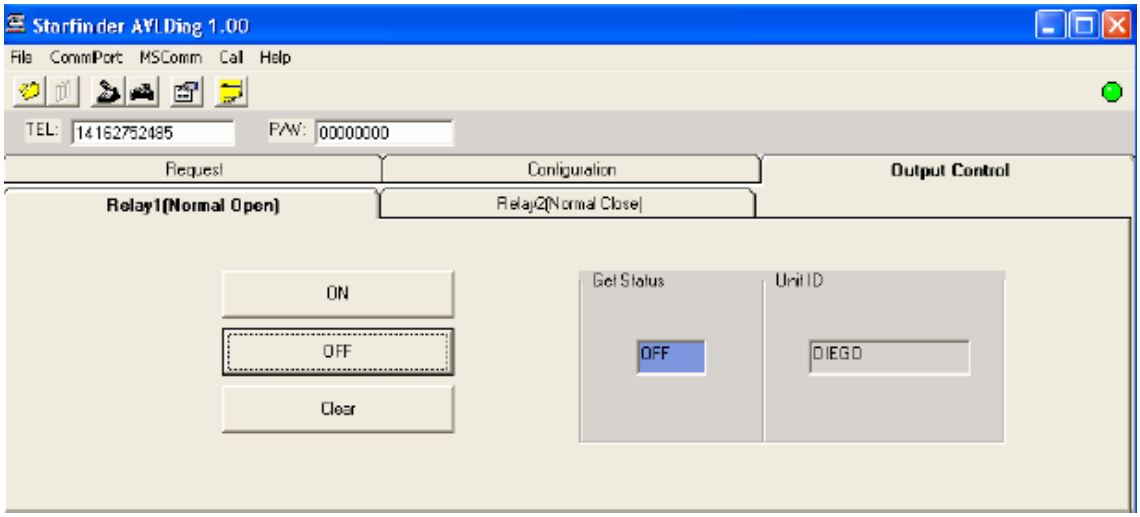
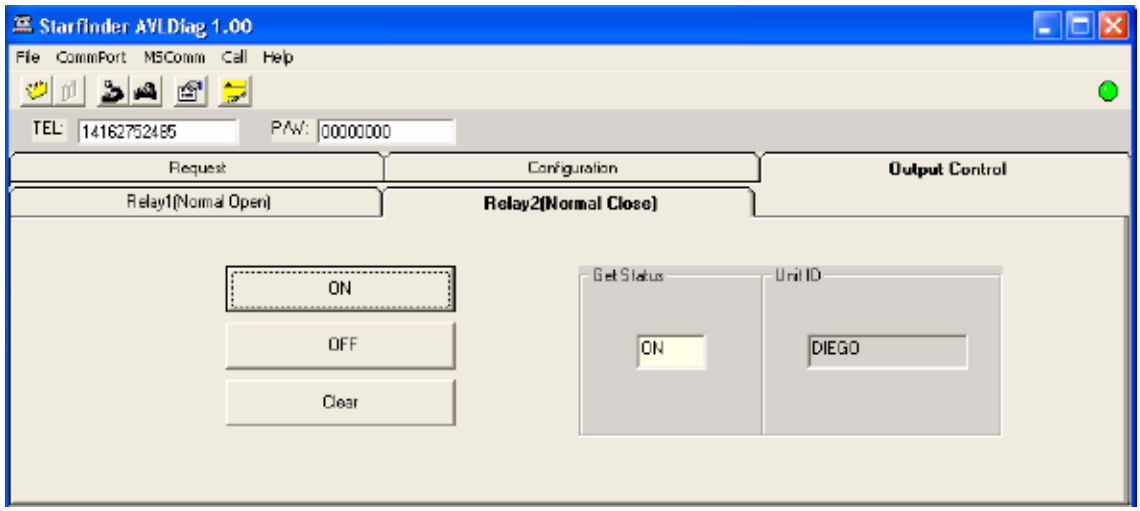
Press 'Clear' button can clear previous received message.



2. Control Relay2:

Start->All Programs->Star Finder AVLDiag1.00->Control->Relay2

Filling in the correct Starfinder Unit phone number in 'TEL' text box
Filling in the correct password (the factory default is '00000000', default Unit ID is '99999999')
Press 'ON' button to switch relay2 ON, or press 'OFF' button to switch relay2 OFF, wait for parameter confirmation message to return.



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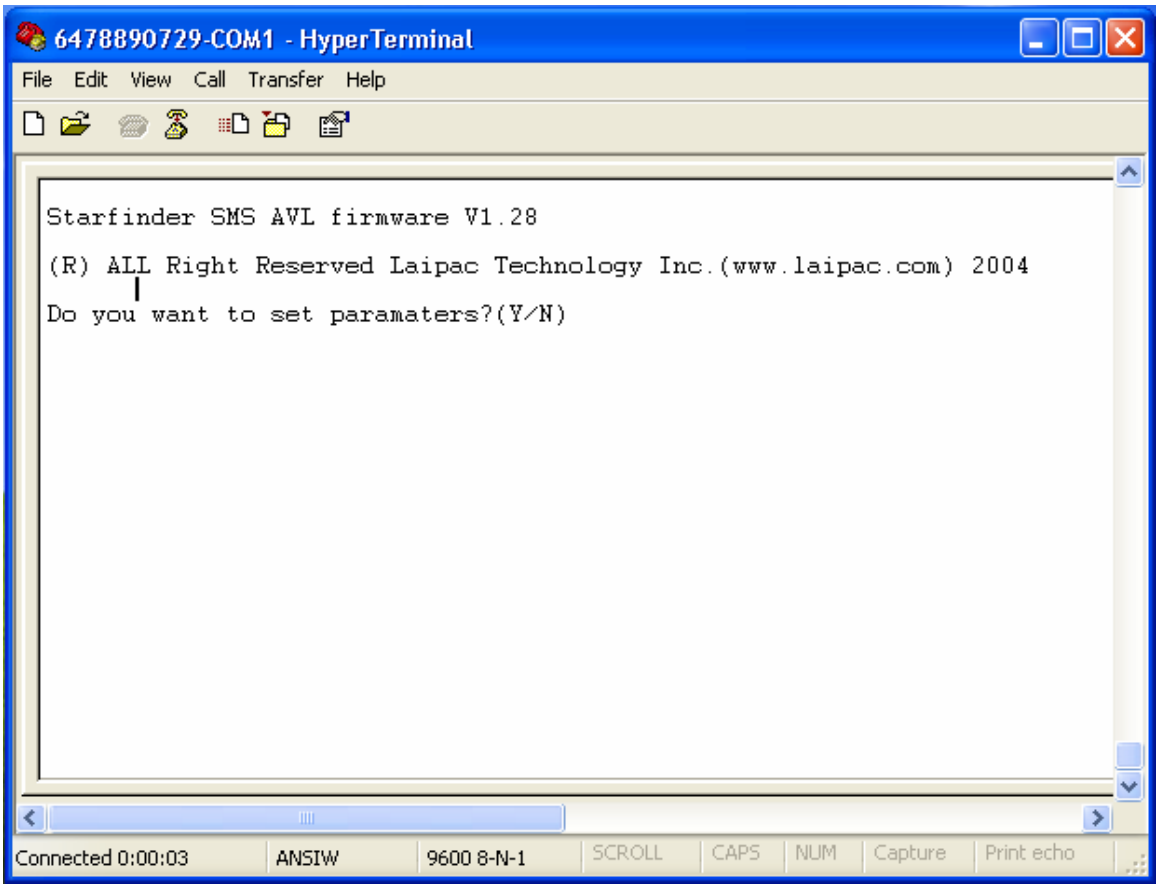
2 - Programming Starfinder Parameter Via Serial Port

Before installation, the basic parameters setup for Starfinder are required. The followings are the procedure:

1. **Using serial cable to connect PC Com1(or Com2) and Starfinder RS232 port(J11)**
2. **Running PC Start->All Programs->Accessories->Communications->Hyperterminal**
3. **Setup Hyperterminal as 9600-8-N-1**
4. **Hypterminal->Menu Call->Call**
5. **Reset Starfinder**

The following screen will appear:



if you don't input any information, after 20sec, Starfinder will exit serial port setup mode and enter normal operation mode:

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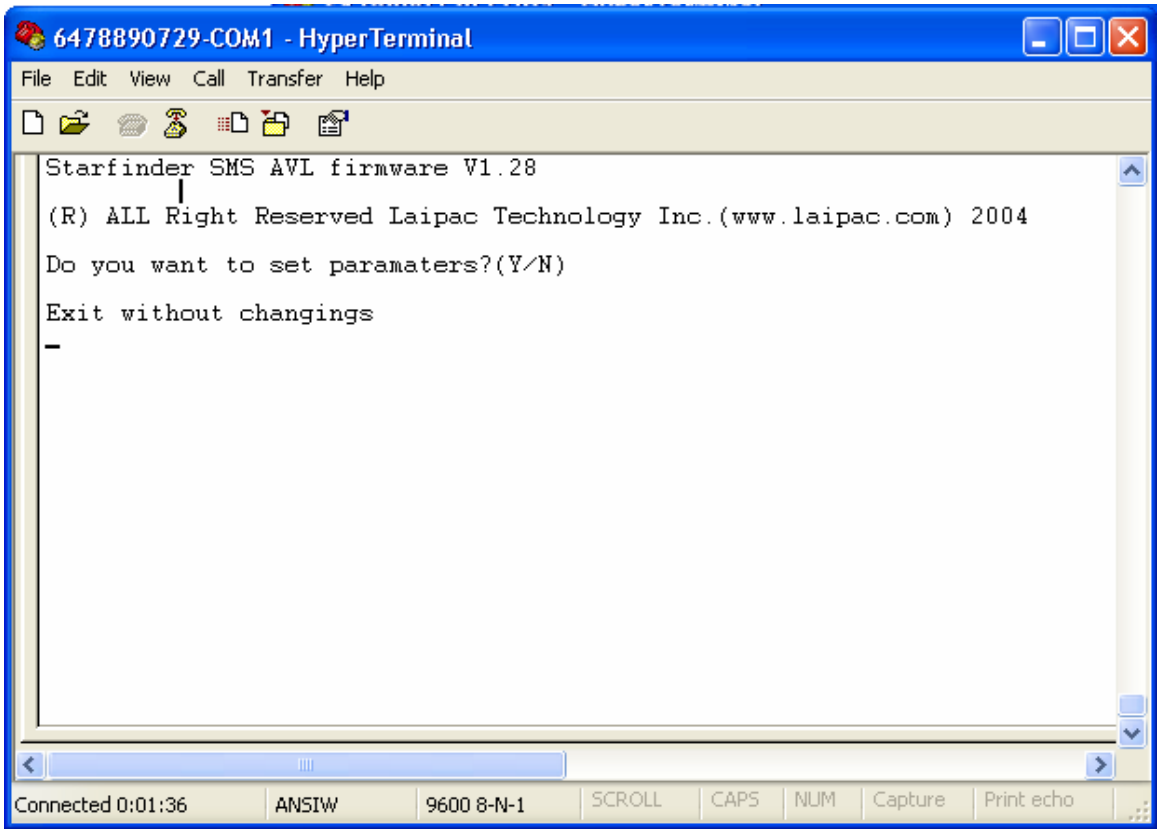
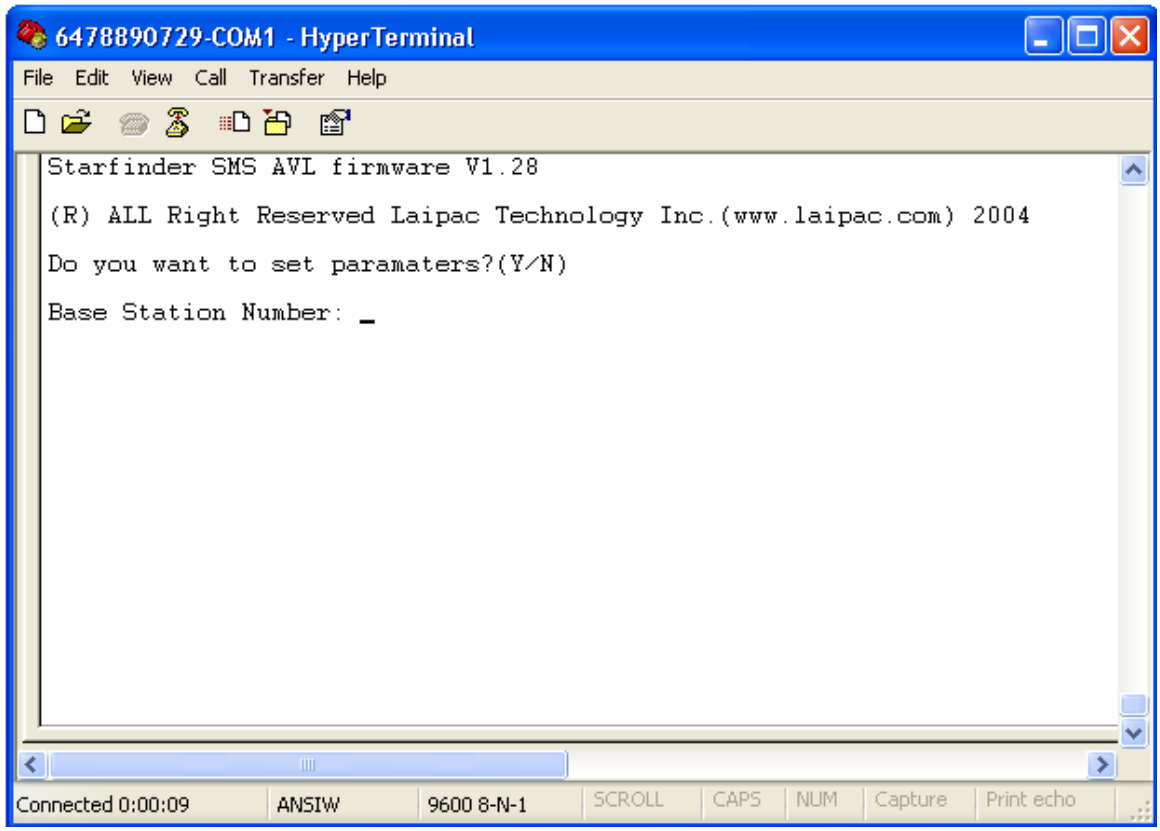


If you type "Y", Starfinder will enter local setup mode, and ask you enter Base Station Number:



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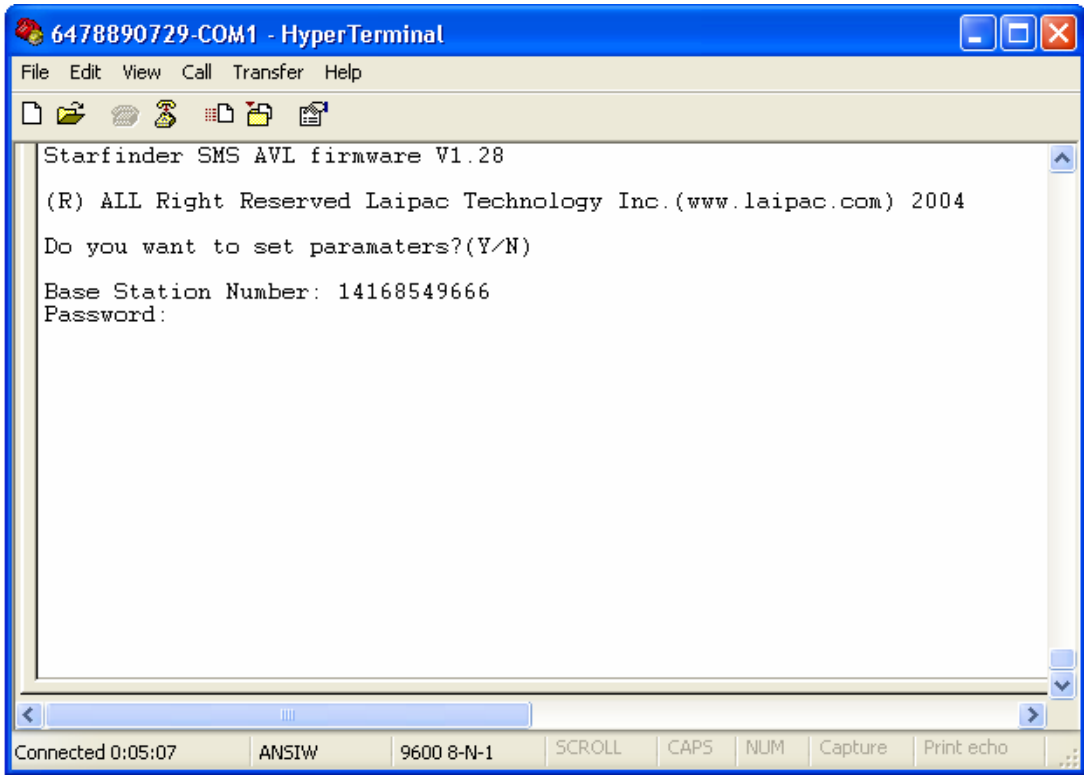
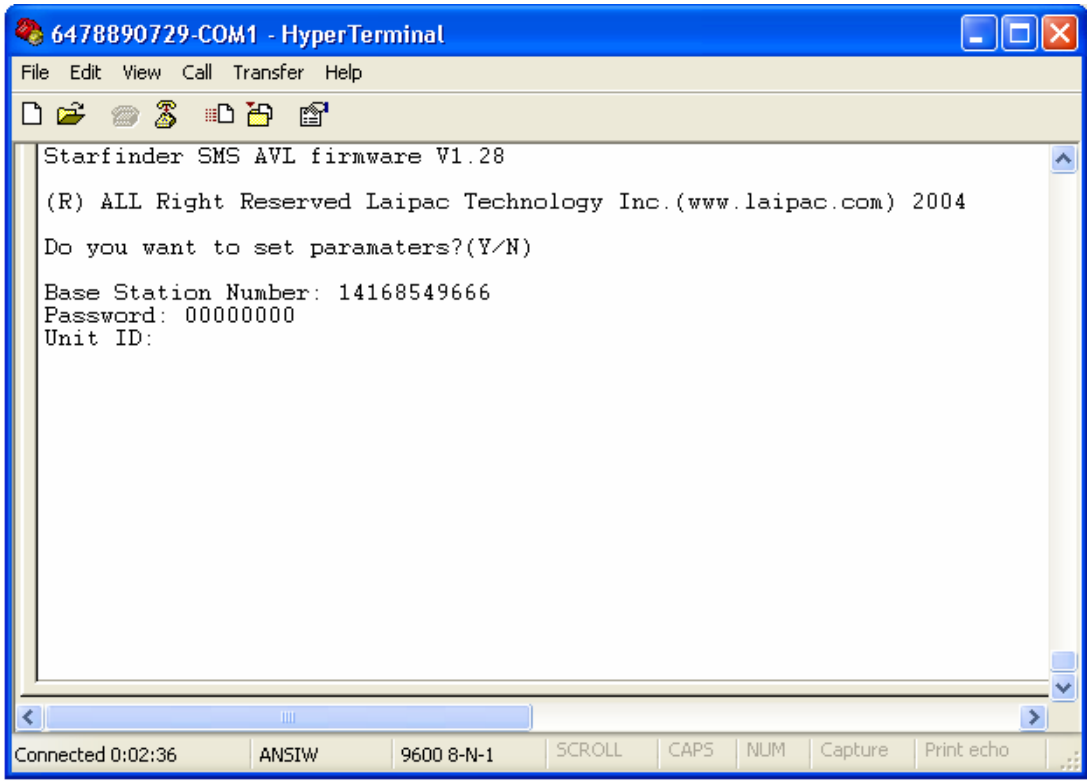
After enter base station number, then Starfinder will ask you input password:



After the password is entered, Starfinder will ask you Unit ID:



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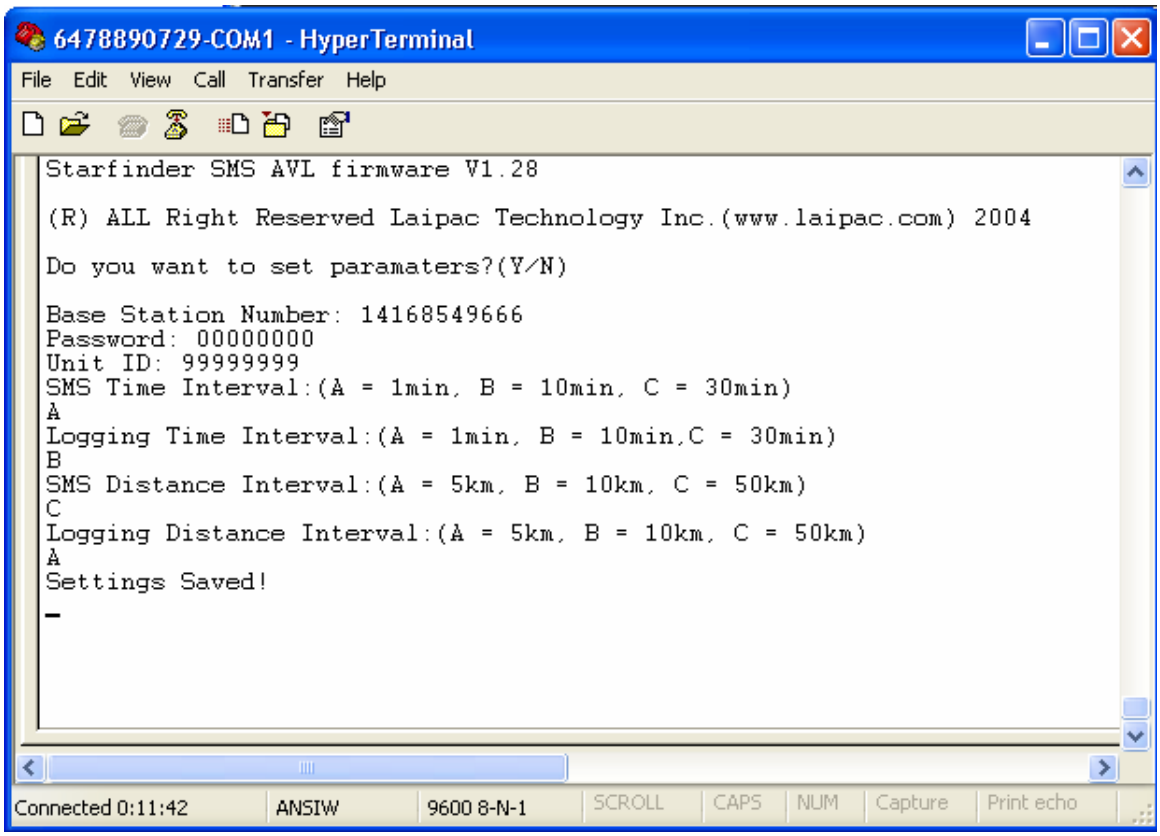
After entered Unit ID, then Starfinder will ask you enter SMS and Data Logging's time interval and distance interval, you can chose only one from A, B or C options for each questions:



When you've answered all of the questions, you'll see "Settings Saved" on the screen, then Starfinder has completed local setting mode and enter normal operation mode.

Each time when Starfinder restart, it will send a short greeting SMS "Welcome using Starfinder" to your base station to confirm that your settings are correct.

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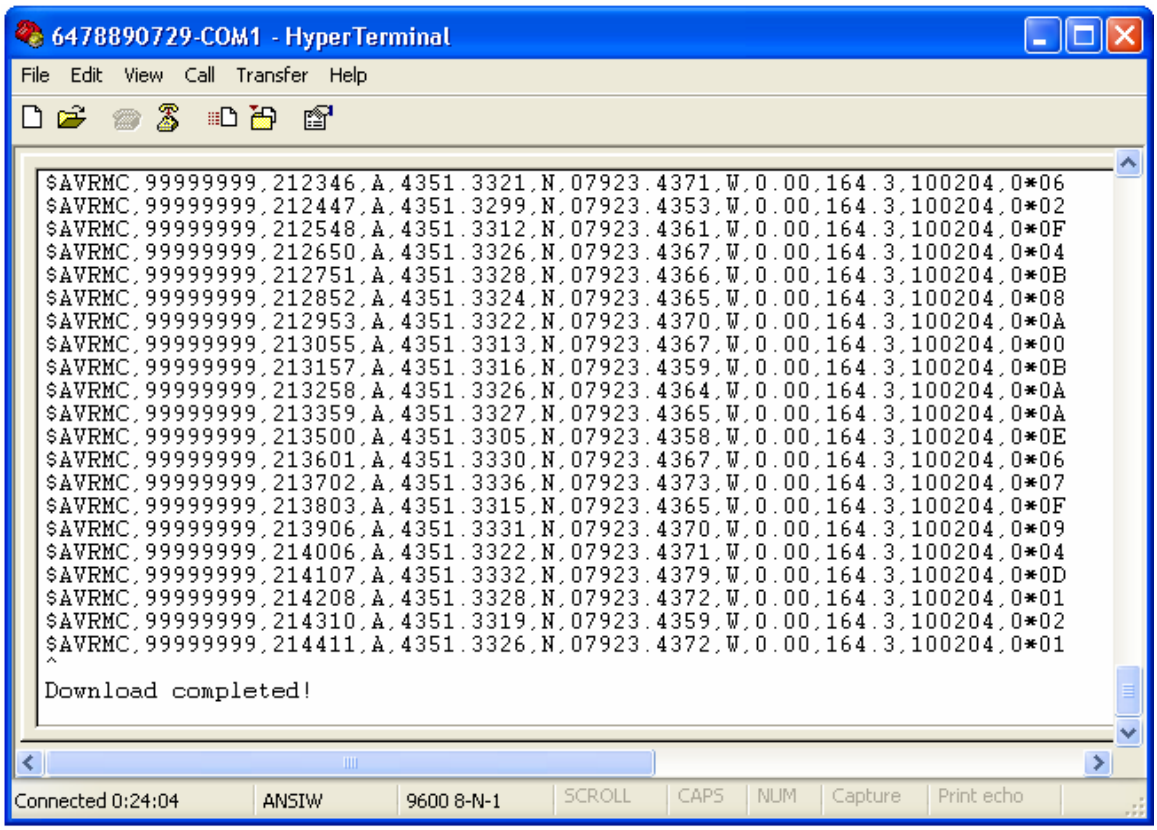
Local Logged Data Download Via Serial Port

In normal operation mode, the serial port will constantly output NMEA $GPRMC sentence at the baud rate of 4800b/s.

Besides sending SMS download all logged data command to download logged data, you also can use PC to send command download logged data directly.

If you use PC software such like HyperTerminal which is connect to Starfinder RS232 port(J11) at the baud rate of 9600b/s, then when you press PC's Enter Key, all logged data will be downloaded from Starfinder RS232 port:



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System specifications

Electrical specifications

Characteristic	*Min*	*Typical*	*Max*	*Units*	*Notes*
DC Supply Voltage	7.0	13.8	48	V	1
DC Supply Current	50	140	240	mA	2
Positive input transient (< 100mS)			60	V	
Peak Current (< 100mS)			1900	mA	
Supply ESD susceptibility			12	kV	
Ambient operating temperature	-25		85	° C	
Storage temperature	-40		120	° C	

Note 1: Starfinder AVL has advanced power circuit design which can be widely connected to any vehicle's DC power.

Note 2: Peak current measured when the system turns on for the first time searching for the network connection.

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GPS engine specifications

Characteristic	*Min*	*Typical*	*Max*	*Units*	*Notes*
Channels tracked		12	12		1
Position accuracy		15 CEP		M	2
Velocity accuracy		0.1		M/S	2
Time accuracy		1		uS	
Cold start acquisition time		48		S	
Warn start acquisition time		38		S	
Hot start acquisition time		8		S	
Maximum altitude tracked		18,000		M	
Maximum velocity tracked		515		M/S	
WAAS/EGNOS/MSAS		Yes			

Note 1: A minimum of three satellites must be tracked for a two-dimensional solution and a minimum of four must be tracked for a three-dimensional position.

Note 2: GPS accuracy is given with Navstar selective availability turned off.

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Package Content for Starting KIT

- **Starfinder AVL unit with SIM card holder**
- **GPS Antenna P1-SMA 5 mts RG174 cable**
- **GSM Antenna P1-GSM-SMA 3 mts RF174 cable**
- **Cable 1 (grey - orange - black - yellow)**
- **Cable 2 (orange - black)**
- **Keyfob (optional, not in the picture)**
- **CD-ROM**

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Optionals

The Starfinder AVL Unit is provided with antennas for GPS and GSM reception, but depending the application other kind of antennas can be used.

Capsule Compact Active Antenna is a high performance 3 or 5VDC GPS antenna. Permanent Mount. The antenna offers a 27 dB gain (active patch). SMA Connector

Ref.: GLP1-RA 3V
GLP1-RA 5V

GLP1-RA

GLP1-CA

Dual GPS/Cell phone antenna. 5 meter cable, operates on 3-5VDC and has SMA connector These antennas are waterproof and comply with automotive temperature and vibration standards.

Ref.: GLP1 – CA GSM
GLP1 – CA CDMA

Dual GPS/ GSM or AMPS. The combination of a high gain GPS antenna and -1 dBi GSM band antenna is ideal for those applications that require durability, small size, covert installation and rugged construction. Available in 3 or 5VDC and magnetic/permanent mounting..

Ref.: GLP1-GC PM GSM
GLP1-GC MM GSM

GLP1-GC

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